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AN
ESSAY
ON THE
Fracture of the Patella
OR
KNEE-PAN ;

CONTAINING

A new and efficacious Method of treating that Accident, by
which the Deformity and Lameness that arise from the
old and common Mode of Treatment, are avoided.

WITH OBSERVATIONS ON THE
FRACTURE OF THE OLECRANON.

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A New Edition,
WITH NOTES,
BY AN HOSPITAL SURGEON.

LONDON:
PRINTED FOR BURGESS AND HILL,
WINDMILL STREET, HAYMARKET.

1819.

Printed by S. Gosnell, Little Queen Street, London.

DEDICATION.

TO

JOSHUA BROOKES, ESQ.

&c. &c. &c.

THE respect the Editor bears towards you, Sir, as a public teacher—the kindness you have shown him personally on many occasions, as well as your having been the quondam Pupil of the distinguished Author of this Essay, the late Professor Sheldon, induce him to inscribe the present Edition to you as a small testimony of his regard.

THE EDITOR.




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ON THE

Fracture of the Patella.



As the methods of cure, which are made use of by Surgeons in fractures of the *Patella*, have long appeared to me defective; as a great number of prejudices have continually arisen in practice, from this subject not being rightly understood; and since those who have had the misfortune to incur this accident, and have been treated in the usual mode, suffer such a degree of lameness as to occasion a very considerable inconvenience in progression, and are likewise rendered more liable not only to refracture the same *Patella*, but also to fracture this bone in the opposite limb, by which means their lameness is doubled, and they hence become disposed, more than before, to falls and fractures of the

Patella, as will clearly be proved in the sequel of these observations ; I have, for these reasons, for a long time since, paid a very particular attention to this disease, and to the anatomy of the parts concerned in the fracture ; and having discovered the cause of this defect in practice, am now able to propose a method of cure, by which all those obstacles which arise from the usual mode of conducting it, and which remain during the life of the patient, will be altogether prevented, and the motion of the limb rendered equally extensive as it had been previous to the accident *. I have been the rather invited to the study of this subject from having been unfortunate (I had almost said fortunate) enough to have fractured the *Processus Olecranon* in my left arm, about ten or twelve years since ; a fracture in many circumstances analogous, in its situation and anatomy, to the fracture

* The Editor believes, that after a complete transverse fracture of the *Patella*, the use of the limb is never so perfect as before the accident, except in the few cases in which ossific union takes place.

of the *Patella*. I therefore hope, as the subject of this Essay is not only new, but very important to all practitioners of the art of surgery, as well as to mankind in general, since it endeavours not merely to clear away old and absurd prejudices, but to establish a new and certain mode of cure, which has its foundation firmly laid in the strong and solid basis of anatomy and experience, that it will meet with a favourable reception.

To understand rightly what I have to offer on the subject, it will be necessary to describe so much of the anatomy of the knee-joint and muscles of the lower extremity as are concerned in this fracture. The *Patella*, *Rotula*, or Knee-pan, serves for the insertion of the extensor muscles of the leg, and is analogous to the *Processus Olecranon*, seu *Ancon*, of the bone *Ulna* in the fore-arm. In some animals, as in the birds of the species *Diomedea Linnæi* (Penguin), the *Patella* is nothing more than a process of bone continued upwards from the *Tibia*; the internal or articular surface enters into the composi-

tion of the knee-joint, it is connected to the *Os Femoris* and *Tibia* by the capsular ligament, and to the tuberosity of the *Tibia* by a strong ligament which is fixed to its lower part, or apex; the upper part, or basis of the *Patella*, receives the large common tendon of the extensor muscles of the leg. The *Patella* is sometimes situated in the anterior portion of the sinuosity, which is found between the condyles of the *Os Femoris*; in the extension of the leg it rises with the extensor muscles and tendon; in the flexion it descends with the leg; the muscles, which are inserted by the intervention of this tendon, are called the extensor muscles of the leg, and are the *Vastus externus et internus*, *Cruræus et Rectus Cruris*. The *Vastus externus* is situated on the outside of the *Os Femoris*, arises from the posterior, or convex rough surface of the great *Trochanter*, from about two thirds of the superior portion and outside of the *Linea aspera* of the *Os Femoris*, and, from a part of the *Fascia lata*, it is inserted into the nearest edge of the common tendon, into

the side of the *Patella*, into the edge of the ligament of that bone, and into the neighbouring lateral part of the head of the *Tibia*; its lowest fibres run in a little behind the *Rectus*, where they are inserted. The *Vastus internus* is situated on the inside of the thigh-bone, arises above by a short flat tendon from the anterior surface of the great *Trochanter*; from the anterior portion of the root of the neck of the thigh-bone, and from the inside of the *Os Femoris et Linea aspera*; it is inserted into the side of the common extensor tendon, which is nearest to it, into the edge of the *Patella*, and on the side of the superior extremity of the *Tibia*. The *Cruræus* arises from all the anterior surface of the *Os Femoris*, which is situated between the two *Vasti*, is united laterally with those two muscles, and is inserted into the common tendon under the *Rectus Cruris*. The *Rectus Cruris, seu Femoris* (so called because it runs straight down the thigh), has a double origin: it is a complete penniform muscle; it arises by a very

strong tendon, which divides into two branches, one short and straight, the other long and bent; the shortest arises from the anterior inferior spinal process of the *Ilium*; the long branch arises from the *Ilium*, is inflected backwards over the *Supercilium* of the *Acetabulum*, and runs in the direction of the *Supercilium*; it is strong and flat, adheres very closely to the bone, and is covered by the capsular ligament and the *Glutæus minimus*: from thence the muscle runs down wholly fleshy, and partly penniform, some of its fibres meeting above and separating below; it is narrow at the upper extremity, and grows gradually broader towards the middle, afterwards it contracts again in the same manner, and at the lower extremity of the *Os Femoris* ends in a broad flat tendon: through its whole course it lies between the two *Vasti*, and covers the *Cruræus*; its inferior tendon is inserted in the upper edge of the *Patella*, from whence it sends down a small plane of tendinous fibres, which adheres very closely to the convex side of that

bone, and, having reached the great ligament, seems to be lost therein. These muscles extend the leg by pulling up the *Patella*, which plays in the groove between the two condyles of the *Os Femoris*, as a rope in a pulley, and therefore these muscles (particularly the *Rectus Cruris*) act with great mechanical advantage; they not only extend the leg, but assist, likewise, in keeping the thigh-bone fixed upon the *Tibia* in the erect posture; in balancing the body; and in straightening the knee-joint, when the legs become fixed points. The *Rectus Cruris*, as it passes over the anterior surface of the hip-joint, is capable of acting upon the trunk, and should be considered as a flexor muscle of the trunk, as well as an extensor of the leg; indeed the whole of the extensor muscles of the leg are capable of bending the trunk: the *Vasti* and *Cruræus* being connected with the common extensor tendon, and this tendon with the *Rectus*, it follows, that the contraction of the fibres of the *Vasti* and *Cruræus*, which are connected with the ex-

tensor tendon, will co-operate with the *Rectus* in producing the flexion of the trunk when the knee-joint is fixed. From the great length of the *Rectus Cruris*, but more especially from its complete penniform structure, it is capable of producing a much greater degree of accurtation than the other extensor muscles, and is inserted to a greater mechanical advantage, by being fixed to the *Patella* in a straight line with the basis. We may observe at present, that the *Vastus externus*, *internus*, *et Cruræus*, with their common tendon, pass over the knee-joint alone, whilst the *Rectus Cruris* passes over the hip joint, as well as that of the knee. The *Vastus externus et internus* are to be considered as half penniform, the *Cruræus* and *Rectus Cruris* as complete penniform muscles. We may likewise observe, that these muscles and the flexors of the leg, which lie upon the thigh, and indeed the other muscles which are situated thereon, and called muscles of the thigh, are all put upon the stretch, when the trunk, thigh, and leg form a right line,

and, on the contrary, are relaxed, when the hip and knee joint are bent.

I shall next endeavour to explain the manner in which the *Patella* is generally fractured. Other bones are most commonly fractured by external violence, the *Patella* in general from internal cause, or, at least, very differently from other bones. A person, for example, is about to fall backward; the trunk of the body at this time is acting with a great length of lever on the inferior extremity; the subject endeavours to sustain the falling weight by all those muscles which pass from the leg and thigh into the anterior portion of the *Pelvis*, and particularly by the action of the *Rectus Cruris*, which is a most powerful muscle, and, as we have before observed, capable of producing great contraction: the other extensors of the leg are likewise in action at the same time upon their common tendon; and as they assist the *Rectus* in the extension of the leg, it is most probable they act with that muscle at this time. The *Patella* is placed exactly between

the condyles of the *Os Femoris*, and is now in contact by little more than a line—the weight of the body falling—the strong action of the muscles, which is produced in jerks—the leg fixed—the knee bent—the *Patella* circumstanced as I have just now mentioned—all these things conspire to produce the transverse fracture of this bone*. At least one of the following occurrences must take place; either the body falls—or it is sustained—or the *Patella* is fractured—or the ligament between the *Patella* and *Tibia*—or the common extensor tendon, which is inserted in the *Basis* of the *Patella*, is lacerated: both of these latter accidents I have likewise seen.

Many of those who have had the misfortune to fracture the *Patella*, have mentioned, that they heard the snapping noise occasioned by its division before they fell to the ground.

We have now a transverse fracture of

* See the London Medical Repository, vol. iii. pages 148 and 278.

this bone without contusion, and extending into the cavity of the joint.

I shall next proceed to the *Diagnosis* of this fracture.

In a recent transverse fracture of the *Patella*, it is certainly not difficult to distinguish the nature of the accident—as the bone is situated so superficially, that the interstice between its divided portions is easily discovered by the eye, as well as by the application of the hands. The superior portion of the fractured bone will be carried upwards towards the thigh, by the extensor muscles, whilst the inferior portion will remain in contact with the ligament which connects it with the *Tibia*.

Great caution is necessary, on the part of the surgeon, in examining fractures of the *Patella*, particularly with respect to bending the knee-joint: if any portion of the tendons of the muscles remain, as those of the *Vastus externus* and *internus*, they are liable to be lacerated by the flexion of the leg; and we have a most remarkable instance, in M. Petit,

of this kind * ; where an ignorant bone-setter, in a case of fractured *Patella*, produced the instant death of the patient, by roughly bending the knee-joint.

We are now to consider what is done by surgeons to effect a cure.

The first principle to be pursued in fractures, is to coaptate the bones, and to retain them in approximation ; this they endeavour to produce by extending the leg, by which means they imagine the extensor muscles are relaxed, and this is certainly the case when the *Patella* is not fractured ; and I have great reason to believe, that most of the opinions that have been entertained upon this subject, have been drawn from the physiology of the parts in a natural state, without considering that the connexion between the muscles and inferior portion of the *Patella* is most generally annihilated when this bone is fractured. They extend the leg, on a supposition of relaxing the *Vastus externus et internus*,

* See Petit, *Maladies des Os*, vol. ii. p. 232.

Cruræus et Rectus Cruris, to the greatest degree: the leg, thigh, and trunk of the body are placed in the same right line, by which position the muscles are not at all relaxed; the superior fractured portion of the bone is drawn up towards the thigh, and removed to a considerable distance from the inferior portion. This separation of the divided portions of the fractured *Patella* depends upon the *Rectus Cruris* being drawn up by its attachments to the *Pelvis*, the anterior portion of which, whence this muscle rises, being at a greater distance from the knee, in the extended position of the trunk and thigh, than when these parts are bent; from the connexion of the *Vasti et Cruræus* with the *Rectus Cruris*, they are drawn towards the *Pelvis* with the common tendon and the superior fractured portion of the *Patella*: instead, therefore, of producing the approximation and co-aptation of the fractured portions of bone, which they intended by this position, they have caused a greater separation of the parts; and from this position being continued,

the elongation of the *Patella*, and lameness that takes place after the cure, most certainly arise *. The surgeon should be exceedingly cautious not to bend the knee-joint, as it may occasion a laceration of those lateral portions of the tendons of the *Vastus externus* and *internus* muscles, which pass downwards, to be expanded in the *fascia* of the leg, and which are likewise connected with the *Tibia* and *Fibula* ; the capsular ligament of the knee, already partially divided, may likewise be more lacerated by such incautious flexion of the leg. The patient should be instructed not to bend the leg ; and therefore such contrivances should be used as will prevent him from effecting flexion during sleep. The extension of the leg will bring up the inferior fractured portion of *Patella* with its ligament, and will approximate and relax the lacerated parts of the capsular liga-

* Elongation of the *Patella* arises from the ligamentous substance which connects the edges of the fractured bones.

ment ; it will relax also, all such fibres of the *Vasti* as are inserted in those lateral portions of tendon which are not torn ; but the *Rectus Cruris*, *Cruræus*, and major part of the *Vasti*, which pass into the strong common tendon which is inserted in the upper part or *basis* of the *Patella*, will not be relaxed at all by extending the leg, as the *Patella* is now divided transversely ; and it is a very remarkable circumstance in the history of surgery, that all the writers upon this subject suppose that the extensor muscles in the fracture of the *Patella*, are relaxed to the utmost by extending the leg ; and those anatomists, whose opinions I am acquainted with, as the late Dr. Hunter, Mr. J. Hunter, the late and present Professor Monro, and every other teacher or writer I have seen or heard of, have entertained the same opinion, though the contrary is evidently the case : this is one of the very many things in anatomy, as well as in other sciences, which has been taken for granted. I believe then, I may venture to assert, that the extension of the leg is only capable of

bringing up the inferior portion of the *Patella*, relaxing the torn capsular ligament, and such fibres of the *Vasti* as are inserted in those portions of the tendon which are not divided.

Let us next consider what further is attempted to effect a cure.

The patient is put to bed, laid on his back, his leg extended ; in a word, his trunk, thigh, and leg, compose a right line : they proceed upon the principle of relaxing the extensor muscles, and bringing the divided portions of bone into contact ; and their principle is just, but the means adopted are inadequate ; they overlook the origin of the *Rectus Cruris*, and full use of the other extensors ; they do not conceive that it is of more consequence, in this case, to consider the position of the thigh and trunk than that of the leg. The fact is, that by placing the trunk and thigh in a right line, those parts of the *Ilium*, to which the *Rectus* is attached, are removed to a greater distance from the *Patella* ; the *Rectus Cruris* is drawn upwards, and the *Vasti* and *Cruræus*, which are connected with the common ten-

don, and now wholly separated from the inferior portion of *Patella*, are drawn up likewise by the *Rectus Cruris* being pulled up, and the superior fractured portion of *Patella* is removed to a very considerable distance from the inferior fractured portion. They next endeavour to keep down the superior and to bring up the inferior portion of *Patella* by bandage; and the continual stretching of the muscular fibres of the *Rectus Cruris*, in this case, excites a species of involuntary action in the muscle, by which it endeavours continually, except perhaps during sleep, to bring up the superior portion of *Patella*, and, of course, to produce a separation between the fractured portions: in short, if the patient is put in this position, the surgeon will find himself incapable of retaining the fractured portions in approximation, with all his art, and all the apparatus his ingenuity may contrive.

In consequence of the fractured portions being removed to a considerable distance from each other, there is no union by *Callus*, but by ligamentous fibres, a circumstance that

does not arise in any other species of fracture ; and, indeed, it is a very fortunate occurrence for the patient that it is not united by *Callus* in this instance, as the elongated bony *Patella* would be more subject to fracture than before the accident. The reason the fractured portions are not united by *Callus*, is, I think, easily explained, if we consider that the *Patella* is a very small spongy bone, and weak in ossific powers ; we cannot suppose, even *à priori*, that a bone of such dimensions should be capable of producing a *Callus* longer, in many cases, than the bone itself.

This fracture is sometimes attended with a considerable degree of inflammation ; in others, little or no inflammation takes place ; when it does, considerable pain will arise from the inflammation spreading to and over, perhaps, the whole of the internal surface of the capsular ligament of the knee-joint, and it is possible (though I have never heard of a case of that kind) that suppuration may take place in the cavity of the joint ; it may there-

fore be necessary, in many cases, to moderate the inflammation, though, in general, it seldom obtains to a great degree.

Let us next consider the defects or ill consequences that arise from the elongation of the *Patella*. In a sound limb, the natural degree of contraction of the extensor muscles is capable of producing the complete extension of the leg, and of acting upon the thigh and trunk, as has been observed in a former part of this Essay. From the *Patella* being lengthened, the extensor muscles are not capable of producing the complete extension of the leg, and other defects must arise in sustaining the trunk, straightening the knee-joint, and other motions of the trunk and lower extremity; hence it must follow, that the inconvenience will be augmented in proportion to the distance between the fractured portions of the bone, as a greater degree of contraction will be required in the extensor muscles of the leg, to compensate for the elongation of the *Patella*. The patient, from not being able to straighten the knee-joint,

will find a great inability in endeavouring to ascend upon inclined planes, particularly in going up a hill or staircase, for the following reasons : In passing an ascent, the knee and hip-joint are bent to raise the foot on the hill or stair, the knee-joint is next straightened by the assistance of the extensor muscles, and this bending and extending of these joints is performed alternately in walking up stairs or ascending hills. It will be found, that those who have fractured the *Patella*, and are treated in the common way, in making such attempts will be liable to fall backward and incur the risk of breaking the other *Patella*; and in many of those who have fractured both, I have known them obliged to be carried up and down stairs, from their being totally unable to effect it alone; for they will find some inconvenience in descending, though not near so much as in ascending. In general, the cause of the defect I have just noticed, has not been rightly understood; some have thought that the joint has been stiff in consequence of the *Callus* shooting or

falling into the cavity of the capsular ligament, or from the capsular ligament being thickened in consequence of inflammation attending the fracture; in short, many causes have been suspected, and I know of no one who has had any just idea of the real nature of this defect, but Mr. John Hunter: he has observed, that the contraction of the muscles after the *Patella* is elongated, was not capable of effecting the complete extension of the leg; and he has proposed to remedy it by a very ingenious method; he advises that the patient should, as often as possible, endeavour to extend the leg to its utmost limits, and he conceives that the muscles will, by such efforts, be rendered capable of producing a greater degree of accurtation. He likewise advises, that the patients be placed in a high chair or seated upon a table, that weights be buckled on the foot near the toes, and that they endeavour to extend the leg as much as possible: the weights are to be augmented by slow degrees. He is of opinion, that by a constant practice of this kind, not only the strength of

the extensors will be increased, but the degree of contraction also; and it may be possible that a small elongation of the *Patella* may be considerably relieved, or even cured by this method; but such elongations as are most generally found to arise from the common mode of treatment, will certainly not be cured by these means.

This very ingenious contrivance of Mr. Hunter's, shows us clearly where the defect lies; it depends upon the elongation of the *Patella*; and therefore teaches us to use every means in our power to prevent it. It is possible that patients, who have fractured the *Patella*, may receive benefit by any contrivance that will bring the divided portions of the bone nearer to each other.

When I came to reflect attentively upon this fracture, the natural actions and co-operations of the muscles of the lower extremity; I soon discovered that the elongation of the *Patella* depended upon the *Rectus Cruris* not being sufficiently relaxed during the cure. It is supposed by anatomists and surgeons, that

the extensor muscles are much relaxed in the case of fracture of the *Patella*, by extending the leg; but I have demonstrated clearly in a former part of this Essay, that this is very far from being the case. The only way to relax the *Rectus Cruris* as well as the other extensors is, to bend the hip-joint, for the muscles are still connected to the *Ilium* at its origin; by this means, not only the whole of the extensor mass will be brought downwards and thus approach the knee-joint, but the superior fractured portion of *Patella* will be approximated with the inferior portion; the *Musculi Vasti et Cruræus* will be relaxed also and depressed. In the former, or old mode of treatment, all these muscles are drawn upwards by placing the trunk and thigh in the same right line: by this method the whole of the situation of the muscles, in this respect, is reversed, they are all loose and relaxed; and now it will be found that the fractured portions of bone can be easily brought in contact with each other without violence, and as easily retained in accurate

approximation by assistance of the bandage hereafter to be described. To place this matter in a clear point of view, I shall mention an experiment or two which I have made, and which any person may repeat with very little trouble, on the living body or artificial skeleton. In a skeleton measuring six feet one inch in height, I found the distance between the anterior inferior spinous process of the *Ilium*, and basis of the *Patella*, when the trunk and limb were in the same right line, to be twenty inches and an half; the distance between these two points, when the hip-joint was so much bent that the thigh and leg formed a right angle with the trunk of the skeleton, was equal to eighteen inches; it is therefore evident, that two inches and one half would have been gained in this subject in a fracture of the *Patella*, by bending the hip-joint so much as to produce a right angle with the trunk; but I shall show presently, that a greater reduction of the space between these two points can be effected, should it ever be found necessary.

In a fractured *Patella* which I have in my possession, the distance between the divided surfaces is equal to one inch, one half, and one eighth; which elongation would certainly have been compensated for, by that position of the trunk and limb which I have just now proposed. The patient to whom this *Patella* belonged, suffered two fractures, at different periods of time, in the same knee: the first time I did not attend her; during the second fracture I was called in, and she was treated both times in the old way, for I had not at that time discovered this method of treating that embarrassing accident.

The greater number of fractured *Patellæ* I have seen after the cure in the old way, have had the separated portions, distant from each other, from three to four inches, and I have seen some at a distance of four inches and a half; specimens of this kind will be found in the plates annexed to this work. If the fractured portions of the *Patella* are accurately united, they will be joined by ossific matter; an instance of this kind is seen in Plate 2.

fig. 3. where it is described with some others which Professor Camper, of Holland, was so obliging as to draw for me when in London, in the year 1785.

In this mode of treatment, those inconveniences I have before mentioned cannot possibly arise, as the *Patella* is not thereby elongated. There is a circumstance of some consequence which I have lately observed, with respect to the position of the limb, and on that account cannot omit noticing it. If the leg be extended so much as to form a right line with the thigh, and the hip-joint be much bent, all those flexors of the leg which arise from the tuberosity of the *Ischium*, and which are inserted into the lateral surfaces of the superior extremities of the *Tibia* and *Fibula*, will be considerably stretched, and render the posture very inconvenient and painful to the patient. I have likewise remarked, if the leg and thigh are so situated, and the former is supported by the calf being placed upon an horizontal plane (a chair for example), that when the person endeavours to

bend the trunk upon the thigh-bone, pain and a species of involuntary action is excited in the bellies of the *Gastrocnemii* muscles; they grow hard and tense; and a sensation like the first approach of a fit of the cramp arises, which is almost intolerable. This inconvenience, which may appear at first sight mechanically impossible to be remedied, without putting the extensor muscles upon the stretch, is in reality easy to effect; and if it be necessary to produce a greater degree of relaxation in the extensor muscles, or, to speak more correctly, if it be ever necessary to depress the superior portion of *Patella*, it can be executed with great ease by bending the knee a little; it will be found that the flexor muscles of the leg are inserted at a greater distance from the centre of motion of the knee-joint, than the extensors of the leg; therefore the flexor muscles will be considerably relaxed by bending the knee a little, and this flexion will occasion no inconvenience in respect to the stretching of the extensors, since these muscles are inserted nearer to the centre of motion of

the joint; for the basis of the *Patella*, where these extensors are inserted, will be raised to a very little distance from the centre of motion. This stretching of the flexor muscles not only depends upon the *Tibia* being extended, but likewise upon the tuberosity of the *Ischium* being farther removed from the thigh-bone, and, of course, the space between the tuberosity of the *Ischium* and those parts of the *Tibia* and *Fibula*, where these muscles are inserted, is increased in length, from the bending the thigh or trunk of the body, and the flexor muscles, in consequence, are stretched, and a painful sensation is excited if the limb is placed in this position. In order to convince my reader of this fact, I would wish him to place himself in a sitting posture in a chair, and to lay his leg, with the calf downward, upon a stool or chair of the same height as that upon which he is sitting; then let him bend his trunk, and he will find a very disagreeable sensation excited not only in the flexor muscles of the leg, but also in the extensor muscles of the *Tarsus*, somewhat

similar to the cramp; it is therefore proved by the foregoing observations, that a small degree of flexion in the knee-joint is absolutely necessary, and this will not produce the least inconvenience in regard to separating the fractured portions of the *Patella*; the divided surfaces may now be brought into accurate contact and easily retained by bandage.

I shall next explain fully the new mode of treatment which has been made use of, and from the adoption of which, the motions of the limb are rendered as extensive as before the accident. In a recent case of fractured *Patella*, if much swelling and tension should come on, I would not put on any bandage, for fear of increasing the tumefaction; I would lay the patient in bed on either side, according to his own custom, or convenience, with the hip-joint bent and the knee a little bent also, as before directed. To ascertain the degree of flexion of the hip-joint, let it be equal to bringing down the superior portion of the fractured *Patella* to unite with the inferior portion; the patient,

in this mode of treatment, lies in an easy, relaxed, and natural position, which he can change from side to side—in the old way, he lies in a very disagreeable and unpleasant situation, being obliged to rest on his back during the time he is confined to his bed. If there is no tension or swelling, the common compound linen bandage, described by Heister, may be made use of; but the one made of leather, described by Mr. Bromfield, and which is prepared by the surgeon's instrument makers in London, will answer better. To prevent the patient from extending the thigh or bending the knee more than is necessary during sleep, some kind of bandage should be made use of; this is so simple and easy to effect, that it is unnecessary for me to describe it. I would advise the patient to wear the bandage on the knee for some time after the union of the fractured bone. Nothing then can be more simple than this method of treatment; and its advantage over the old mode must be obvious to every can-

did person who is acquainted with anatomy, and who will read this Essay with attention.

This mode of treatment has been carried into practice, and has been found to be equal to producing a perfect union of the fractured portions of the *Patella*, and the *Patella* has not been lengthened; the limb has been as strong as before the accident took place, and the different motions of the knee-joint equally extensive*.

* After relaxing the muscles in the manner described in this Essay, my plan in hospital practice has been, to bring down the upper portion of bone in close contact with the fixed inferior part, taking care to prevent the interposition of any portion of lacerated ligament or tendon, by raising the soft parts covering the fracture, with the fingers and thumb of both hands, and keeping it so raised while an assistant applies the usual bandage: for, it must be very apparent that the interposition of a portion of lacerated tendon or ligament will prevent the possibility of any kind of union taking place until such substance be removed by absorption.

In order to prevent the spasmodic twitchings of the extensor muscles of the leg, which frequently occur in cases of this kind, from separating the already approximated portions of bone, I have, also, found much benefit by the application of a calico roller passed round the thigh from the groin downwards to the knee.

It appears from what has been said on the anatomy and physiology of the knee-joint, in the sound and diseased state, arising from the elongation of the *Patella*, that this joint is weak, loose, and unstable after the cure in the old way: this arises from the *Patella* and ligament being loose, owing to the elongation; and on this account also, the knee is liable to bend, from not being kept so firm as it is by the action of the extensor muscles, keeping the *Patella* and ligament firmly and rigidly fixed in the sound state of these parts: owing to the joint being loose, the knee is rendered liable to bend, and the subject to fall and fracture the *Patella* again, or the *Patella* on the opposite side.

This laxity and instability in the knee-joint, arising from the old mode of treatment, and the disposition to refracture the *Patella*, is altogether prevented by the method described in this Essay; and if the surgeon will reflect, he will find a great analogy between this mode of treatment and the bending of the knee-joint in a lacerated *Tendo Achillis*.

The common and old practice in the lacerated *Tendo Achillis*, which arises somewhat in a similar way to the fracture of the *Patella*, is to extend the *Tarsus*, by which the inferior portion of the tendon is carried upward towards the superior portion; but the knee should, and is kept bent in this case by judicious and discerning surgeons, by which means the exterior mass is brought downwards; and this depends upon the *Musculus Gastrocnemius* taking its origin from the thigh-bone.

In a case of laceration of the ligament of the *Patella*, or laceration of the common tendon of the extensor mass of the leg, the same position of limb is to be maintained as in the treatment of the fractured *Patella* in the new way, and the limb must be kept fixed in this situation until, and for some time after, the union takes place; by which means an elongation of the ligament or tendon will be prevented, as well as the consequent defects and deformity that will otherwise arise in cases of this kind. If patients who

have suffered lacerations of the *Patella*, or the extensor tendon, are not treated upon the principles here laid down, they will be lamed and rendered liable to relacerate the ligament or tendon; and I know an instance of an eminent surgeon in London, who met with this accident by endeavouring to step into a coach. In this gentleman the extensor tendon was lacerated by a strong exertion of the extensor muscles of the leg, on one side, acting powerfully upon the trunk to bend it, and to carry the body into the coach. In this case the trunk and lower extremity was laid in the same right line during the cure; the tendon, of course, was elongated; the joint rendered weak, loose, and unstable from the elongation; and I suspect that the extensor muscles dwindle and degenerate in these cases after the accident, and lose considerably of their muscular energy. This gentleman has since relacerated the tendon.

Some have supposed that a stiff joint may arise in cases of fractured *Patellæ*, from the *Callus* shooting into the cavity of the knee-

joint; but the dissections which have been made after death, show us that nothing of this kind takes place, and that the elongation of the *Patella*, in these badly managed cases, is formed of ligamentous substance.

I am sorry to disagree with Mr. Pott in two points respecting the fractured *Patella* *. I am certain from experience, that those will walk best in whom the fractured portions of the *Patella* are brought into accurate contact; and longitudinal fractures succeed better than transverse, for this reason, since the fractured portions of bone are kept in accurate contact by their natural connexions, in such longitudinal fractures †. Mr. Pott says,—
 “Those walk best in whom the broken pieces are not brought into exact contact, but laid at some small distance from each other.”

* See Chirurgical Works, by Percival Pott, F.R.S. &c. in quarto, p. 996 and 997. Printed in London, 1775.

† Another reason why longitudinal fractures succeed better than transverse ones is, that in this case laceration of the capsular ligament and extensor tendon is much less likely to occur, as such fractures are known, generally, to be produced by falls or blows upon the *Patella*.

But I would ask Mr. Pott, whether he ever saw a simple transverse, or even a longitudinal fracture of the *Patella*, where the portions of fractured bone were brought and kept in accurate contact during the cure, where any inconvenience was the consequence. I declare I never saw a cure treated in the old way, without producing an elongated *Patella*. If surgeons think to make the *Patella* of a better form than nature made it, they are much mistaken.

During the latter part of the cure the joint may be cautiously moved, to prevent any stiffness arising from want of motion, or from a supposed thickening of the ligaments; taking care, by embracing the *Patella* with the hand, to prevent any displacement of the fractured portions of bone. The simple longitudinal fracture of the *Patella* requires no bandage upon the fractured part, as the natural connexion will keep the divided portions in accurate contact; and in this case, we may and should relax the extensor muscles a little during the cure, as the inflammation

will be more liable to subside from the capsular ligament of the knee-joint being relaxed.

I must likewise object to Mr. Bell. He says, in his *System of Surgery**, “It is a fortunate circumstance, however, that it is not absolutely necessary to a complete cure, that the different pieces of bone be kept in exact contact. Where it can be easily done, it ought always to be put in practice; but I know from the result of several cases where this was impracticable, that a cure may be obtained, and the joint be equally firm and useful as it was before, even although the separated portions of bone cannot be brought within an inch of each other. We should not therefore be very anxious about this, and instead of using much force for the purpose of drawing the bones into close contact, no more should be employed than the patient can bear with perfect ease.”

Whichever follows Mr. Bell (and does not

* See a *System of Surgery*, in octavo, vol. vi. by Mr. Benjamin Bell, p. 116. Printed at Edinburgh, 1788.

bring the fractured portions of the *Patella* into accurate contact, which may always be effected by bending the hip-joint, and bringing down the extensor muscles, and superior fractured portion, without giving that pain, which Mr. Bell says is produced by attempting to bring the fractured portions into accurate contact), will undoubtedly lame his patient; but Mr. Bell, like all those who have gone before him, uses the extended position; and I aver, contrary to Mr. Bell's opinion, that whenever the portions of *Patella* are not brought into contact, the defect is in proportion to the separation of the fractured parts; while, on the contrary, if the fractured portions are brought and kept in accurate contact, during the cure, the patient will walk as well as before the accident, without any inconvenience in the motion of the knee-joint, and without that predisposition to refracture the *Patella*, which arises from the maltreatment of this case in the old way, or the risk of fracturing the opposite *Patella*, and of refracturing both, and of receiving possibly,

in the falls occasioned by these fractures, greater and more fatal mischief.

Those who have the misfortune of having the diseased loose knee-joint, from the mismanaged fractured *Patella*, will be assisted by wearing a laced knee-cap, which will give a degree of firmness to the joint.

I shall next consider the fracture of the *Olecranon*, an accident very analogous to the fracture of the *Patella*.

On the FRACTURE of the OLECRANON.

As the fracture of the *Olecranon* is frequently badly treated, and as this part is analogous, in its situation and use, to the *Patella*, I have thought proper to add some observations, seeing very little has been written on this subject; and from having fractured this part in my own body, I have been led to a very particular consideration of this malady.

The *Olecranon* is a process arising from the superior extremity of the bone *Ulna*. Into the upper part of this process, the tendon belonging to the extensor muscles of the arm is inserted in a similar way to the insertion of the extensor muscles of the *Patella*. The internal surface of the *Olecranon* forms a part of the articular sigmoid cavity, which enters into the composition of the elbow-joint; for which reason fractures of this process almost always reach into the cavity of the joint: it is therefore certain that any deformity of the articular surface of the *Olecranon* will impede the free motion of this joint; and, in some cases, a stiff arm, almost equal to a complete *Anchylosis*, is the consequence of ill-treatment in these cases.

Like the *Patella*, the *Processus Olecranon* rises in the extension, and is depressed in the flexion of the fore-arm; when the process is fractured, the extensor muscles are separated from the body of the *Ulna*, but are still connected with the superior fractured portion of the process. It is supposed by the major

part of surgeons, that a stiff arm, or *Anchyl-
losis*, is the consequence of even simple frac-
tures of this process; and this will arise in
such cases where the fore-arm is kept bent
during the cure: but this will not arise in
simple fractures of the *Olecranon*, if the me-
thod I shall describe is followed.

I know of no instance of fracture of this
process, by a strong action of the extensor
muscles, like that of the *Patella*;—it is most
commonly fractured by falls or blows*.

It is easy, in recent cases, to distinguish
a fracture in this process, by the usual appli-
cation of the hands; and, if much swelling
and tension has taken place, the *crepitus* of
the broken parts will easily be detected, upon
gently moving the joint. Surgeons are so
accustomed to bend the elbow-joint, in inju-
ries of the fore-arm, that they bend it in ge-

* The *Olecranon* being a process of the *Ulna*, and the
neck of this process much narrower than its superior part
which occupies the hinge concavity of the humerus; al-
most every fracture of this process must necessarily be
transverse.

neral in fractures of the *Olecranon*. If the bent position is maintained, a stiff arm is the inevitable consequence, for the following reasons. The upper fractured portion of the *Processus Olecranon* being separated from the inferior portion, and being still connected by the extensor tendon with the *Musculus triceps Extensor Cubiti*, the bending of the fore-arm removes the lower portion of the *Olecranon* from the superior portion; a space is left between the two fractured portions of bone; *Callus* is afterwards formed, filling up the space between the two fractured portions, and uniting them; by this means, the *Olecranon* is unnaturally lengthened, the articular surface has got an imperfect form, and its concavity does not correspond with the convex articular surface of the *Trochlea* of the *Os Brachii*, upon which it revolves in the flexion and extension of the fore-arm; and it is even possible that the free motion of the *Radius* may be affected by a redundant *Callus*, in such maltreated cases. In order that my readers may understand rightly this fracture,

and my observations upon it, I shall consider next the anatomy of the parts concerned in this fracture.

The joint of the elbow is composed by three bones, the *Os Brachii*, the *Ulna*, and the *Radius*, and is a simple hinge-like joint;—the *Trochlea* or pulley of the lower extremity of the *Os Brachii*—the sigmoid cavity of the *Ulna*, which is situated on the internal surface of the *Olecranon*—and the glenoid cavity lying upon the head of the *Radius*, form the three articular surfaces composing this joint. Between the two condyles of the *Os Brachii*, immediately above the *Trochlea*, we may observe a cavity behind, which receives the *Processus Olecranon*, and locks it in the extended position of the arm, making the arm and fore-arm in this state, nearly as firm, rigid, and inflexible, as if the whole consisted of one bone. There is a smaller cavity between the two condyles on the anterior surface of this bone, which receives and locks the coronoid process of the *Ulna*, and keeps the fore-arm firmly fixed, in the greatest state of flexion. The motions

of this joint are flexion and extension. The flexion is effected by two muscles, which are situated principally on the anterior surface of the *Os Brachii*; the one is named *Biceps Flexor Cubiti*, the other *Brachiceus internus*: the *Biceps* is inserted in the tuberosity of the *Radius*, and throws off an *Aponeurosis* which is expanded on the muscles lying on the anterior part of the bones of the fore-arm; the *Brachiceus internus* is inserted in the anterior surface of the *Ulna*, just below the coronoid process. The extensor mass lies principally on the back part of the *Os Brachii*, and is called the *Triceps Extensor Cubiti*; there is likewise a small extensor muscle named *Anconæus*, which is, in my opinion, a continuation of the *Triceps*. The *Triceps* arises by three heads: the long head arises from the lower edge of the *Cervix Scapulæ*; the second and third heads, forming the *Brachiceus externus* of Douglas, arise from the back part and outside of the *Os Brachii*. The *Triceps* is inserted by a strong and flat tendon in the upper part of the *Processus Olecranon*: the

muscle called *Anconæus* is a continuation of the lower muscular portion of the *Triceps*, which is inserted in the *Ulna*, a little below the *Processus Olecranon*: this muscular mass produces the extension of the fore-arm. Whoever considers the anatomy and physiology of the parts concerned in this fracture, will find that the bent position of the fore-arm, not only tends to separate the fractured portions of the broken *Olecranon*, but leaves a space between the *Os Brachii* and *Ulna*, and forms a cavity in the joint, into which the *Callus* is at liberty to shoot. The consequences arising after the cure are a mal-conformation in the *Processus Olecranon*, owing to its being lengthened, and, as before observed, getting into the cavity of the joint. Although the lengthening of the process is sufficient to lame the patient for life, this will depend on the upper large portion of the *Olecranon*, instead of falling into the natural cavity made to receive it, in the extended position of the fore-arm, pressing above the cavity of the *Os Brachii*; and, of course, a

lame stiff arm is the consequence of the surgeon's having maintained the bent position of the fore-arm.

If any doubt should arise of the lameness not proceeding from the elongation in maltreated cases, from the bent position being used, let the *Ulna* of the sound arm be measured from the point of its styliform process to the upper part of the *Olecranon* in both arms; when it will be found that the *Ulna* is longer in the broken than in the sound fore-arm. This can be easily effected, with great accuracy, as the *Olecranon* and the styliform process can be distinctly felt in the living body.

I am of opinion that something might be done to relieve those who have had the misfortune to be lamed in cases of the fractured *Olecranon*; and I should not hesitate, in a recent case of this kind, finding the lameness to depend merely upon the elongation by *Callus*, as the *Olecranon* is not covered by any muscle or large vessels of any kind, to take out the elongated portion produced by the *Callus*; I should hope, however, that no

man would attempt this operation, but an expert practical anatomist; and I wish my readers not to apply an operation of this kind to any other case than the elongated fractured *Olecranon*. The method of performing this operation I will describe after I have considered the proper methods of treating the fractured *Olecranon*. In a recent case of fractured *Olecranon*, it is the duty of the surgeon to bring the fractured portions into accurate contact, to prevent and diminish as much as possible inflammation, in order to prevent suppuration taking place in the joint, and to leave the muscles connected with the process, in a state of relaxation. This he will effect by extending the arm. In so doing, he will bring up the lower fractured portion of *Olecranon*, which will now get into contact with the superior fractured portion; he will relax the extensor muscles, which will be put upon the stretch in the bent position, owing to the connexion which the *Musculus Anconæus* has with the *Ulna*, below the fractured *Olecranon*, and the *Musculus Triceps* above the

joint ; he will, by extending the fore-arm, lock the superior fractured portion of *Olecranon* in its natural cavity, formed by the posterior semilunar cavity of the *Os Brachii*. The cavity of the joint no longer exists when the fore-arm is extended, since the *Ulna* and *Trochlea* are now in accurate contact in all points of their articular surfaces, and the *Callus* cannot shoot into the cavity of the joint ; therefore, every kind of mischief capable of arising from the *Callus* filling the cavity of the joint, is prevented, and a redundancy of *Callus* is avoided, by the fractured parts being in accurate contact, and, of course, the *Ulna* has its old original length and form, in all parts ; so that a simple fracture of the *Olecranon*, after the cure, cannot be distinguished by the best surgeon, in cases of this kind, that are well treated. The acute pain and great inflammation that will attend the majority of cases, when the fore-arm is bent, by keeping the extensor muscles and capsular ligament upon the stretch, and separating the fractured portions of the *Olecranon*,

will be diminished, and soon removed, by maintaining the extended position. The posterior semilunar cavity, which is situated between the two condyles of the *Os Brachii*, will fix the separated portion of the fractured *Olecranon* so steadily as to prevent any elongation or redundant *Callus*. No splints or other inventions of the chirurgic art, can possibly retain it in such accurate apposition as the proper cavity, formed by nature to receive it. It is a long time, in general, before the fractured portions are united by *Callus*; I would therefore advise the surgeon to embrace the fractured part with his fingers, and move the fore-arm, by bending and extending it during the latter part of the cure, to prevent any stiffening or improper adhesion of the capsular ligament, which, we may suppose, is sometimes lacerated in fractures of the *Olecranon* *. It may not be improper to move the *Radius* also, by the pronation and

* See note at page 35, as the observations contained in that note are equally applicable here.

supination of the hand, placing the fractured parts, after making such motions, in the extended state, as before directed, and securing the parts in that position by bandages and splints *.

In a former part of this Essay, I hinted that something might be done to relieve those who have fractured the *Olecranon*, and in whom it is elongated, from the bent position having been made use of. In a recent case of this kind, where a stiff arm was the consequence, I proposed to remove the elongated new-formed portion, and to reduce the *Ulna* to its original length and form. The propriety of performing such an operation rests upon the following considerations: that the

* All the splinting the Editor has found necessary in cases of fractured *Olecranon*, has been the application of one splint down the inside of the arm, long enough to reach from a little above the insertion of the tendon of the deltoid muscle, to within a couple of inches of the wrist, and this kept in situ by a roller, passed round the arm and splint together. The flexion of the arm is thus totally prevented, and the fractured edges of the *Olecranon* are undisturbed during the progress of the cure.

bone at this part is covered only by skin—that the cavity of the joint is small—that the *Ulna* in the opposite arm may be measured from the styliform process to the upper part of the *Olecranon*, and, being compared with the diseased *Ulna*, the quantity of the elongation may be discovered; added to this, I have seen two inches and a half of the *Ulna*, with the *Processus Olecranon*, removed in a case of venereal caries, by the late Mr. Justamond, in the Westminster Hospital, with such success, as to leave a tolerably good joint, with very considerable motion. This operation might be easily effected by making a semi-lunar incision in the skin, in the longitudinal direction of the *Olecranon*; which will give the surgeon every advantage of the crucial incision: he may readily dissect the skin from the adjacent bone, as it may be kept out of his way by the assistants: he is then to remove the new-formed portion by a very fine saw; having removed it, he is next to place the arm in an extended position, by which means he will carry the superior now separated portion

of the *Olecranon*, which adheres to the tendon of the extensor mass, into the posterior semi-lunar cavity of the *Os Brachii*. The lips of the wound in the skin are next to be brought into accurate contact by pieces of adhesive plaister and proper bandage, and splints applied to maintain the extended position of the fore-arm. I should entertain little doubt of success attending this operation, if well executed, as it might be by an expert practical anatomist. If well done, it would not be attended with a great deal of pain, as the skin might be quickly divided, and bone is hardly sensible in a sound state; motion should be used, as before directed, during the latter part of the cure.

In old cases of stiff arms from this cause, this operation should not be performed, as the muscles will mould themselves to the bent stiff arm, and the form of the bones in and about the joint alters: this I have found to be the case, from the dissection of such joints after death.

THE END.

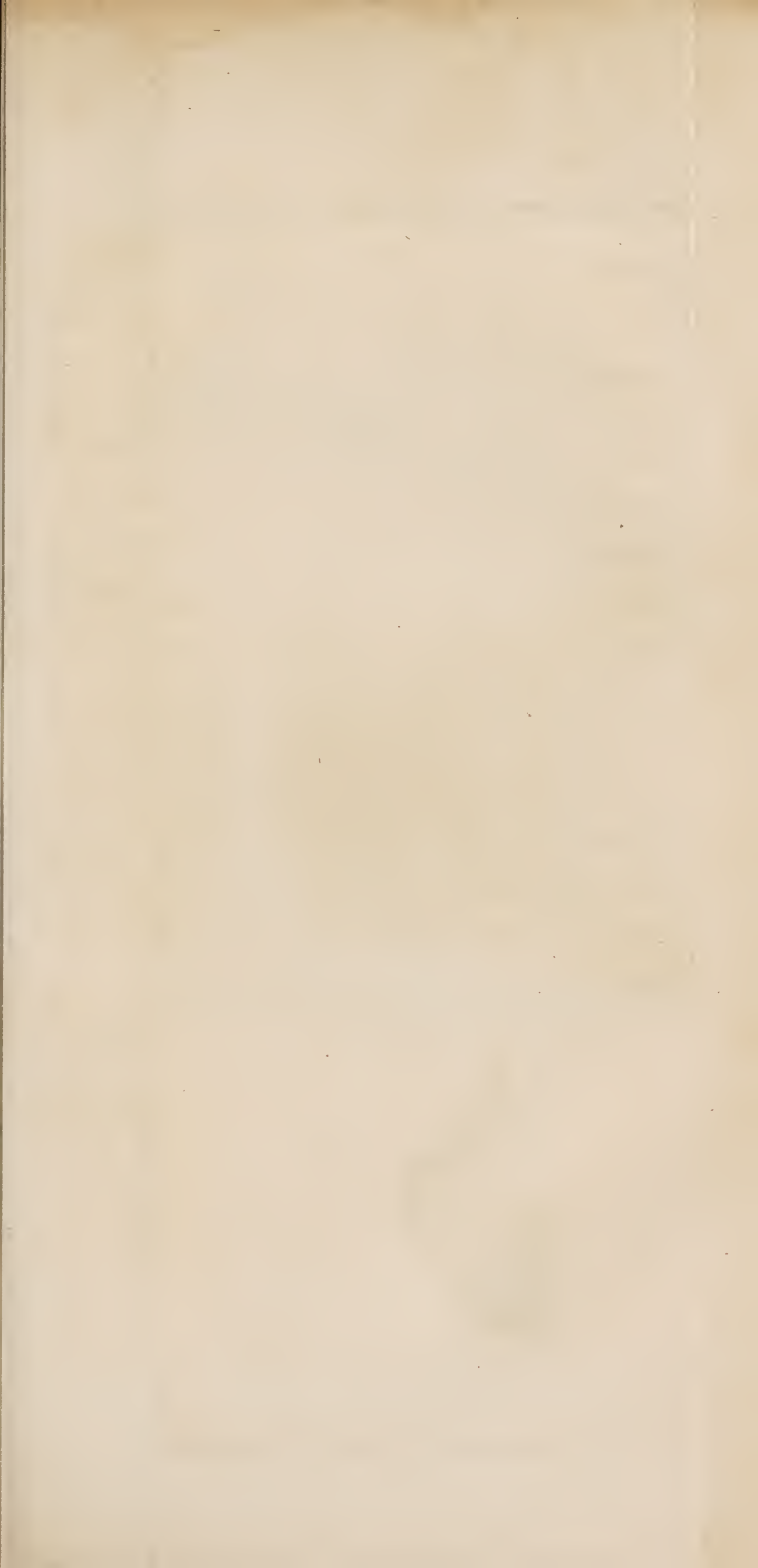


Fig. 1.

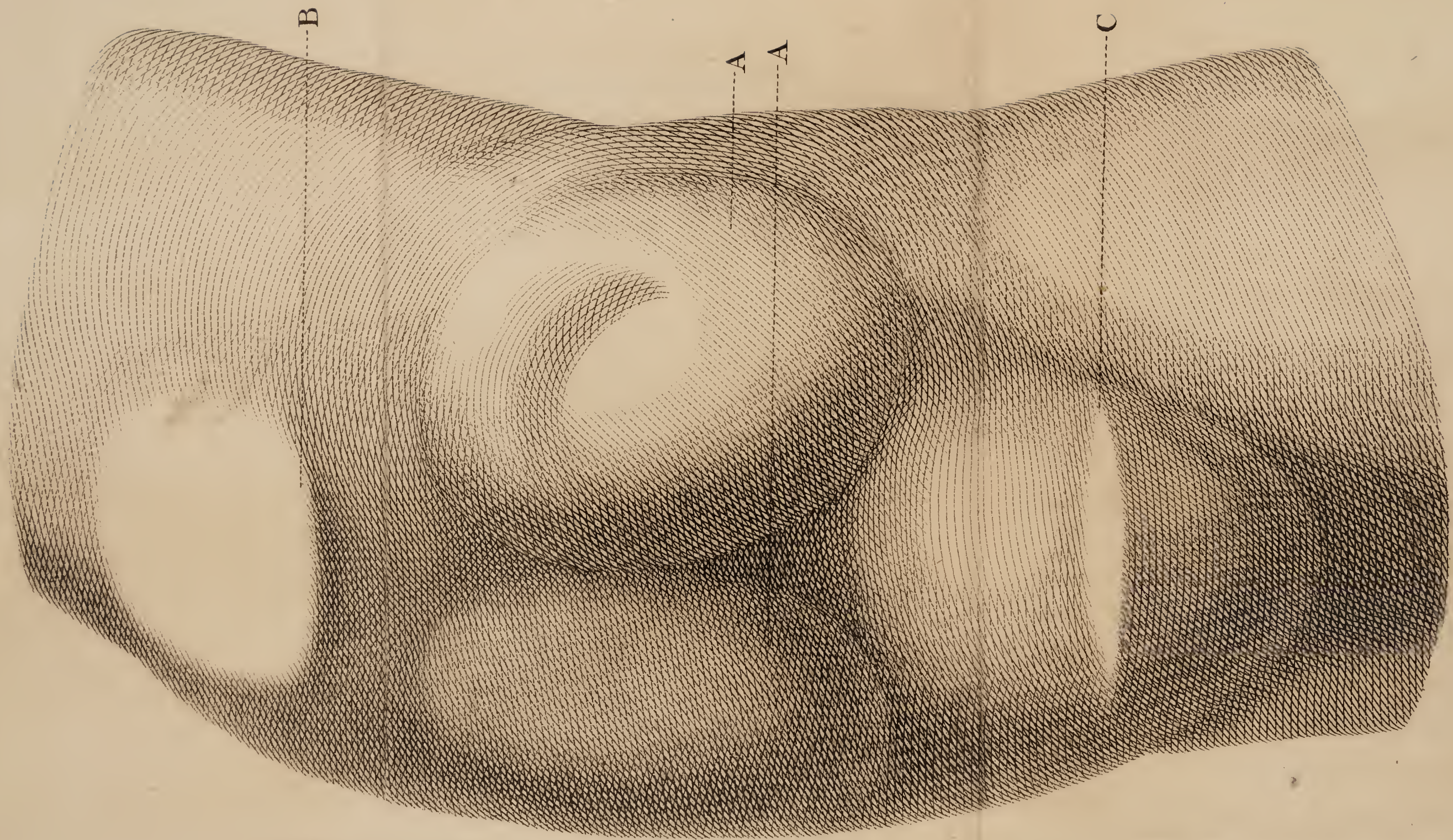
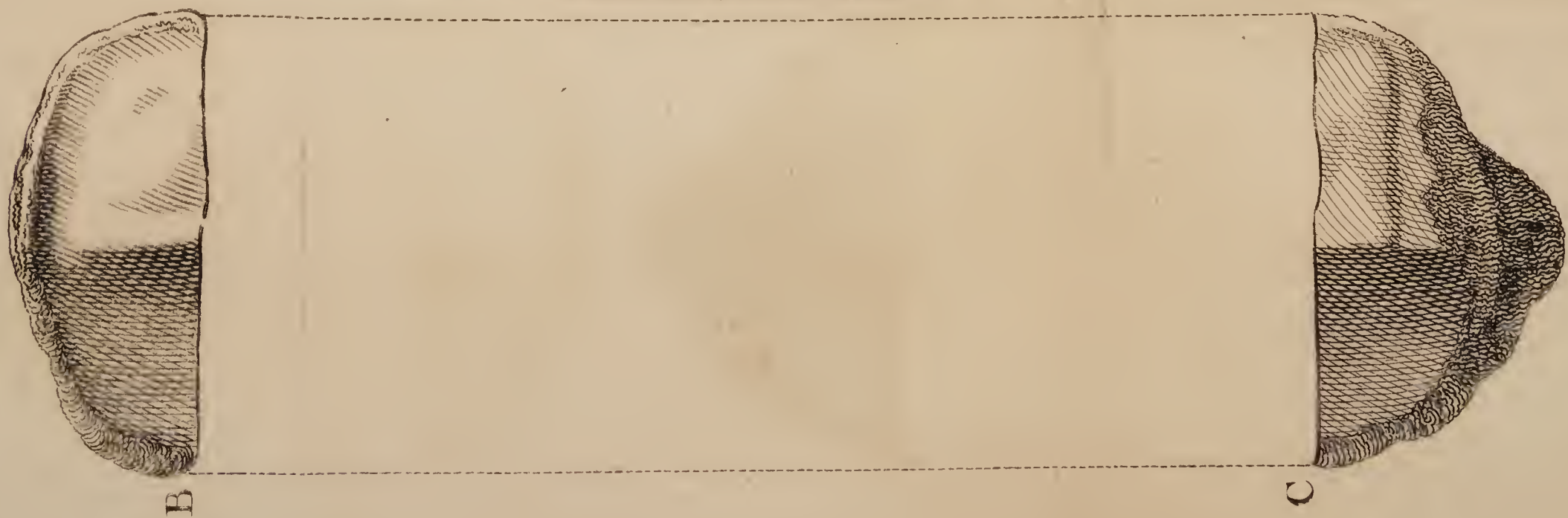


Fig. 2.



EXPLANATION OF PLATE I.

FIG. 1. Represents the knee of a person of the natural size, after the cure of the fractured *Patella* in the old way.

A. A. Point to the condyles of the *Os Femoris*, which project, and may be seen in these cases, when the knee is bent a little.

B. Marks the lower edge of the superior portion of the fractured *Patella*.

C. Shows the superior edge of the inferior portion of the fractured *Patella*; between these two portions the new-formed ligamentous substance is found, which unites the fractured portions in these cases.

N. B. The knee, treated in the new way, has its natural appearance after the cure.

FIG. 2. A view of the fractured *Patella* of this knee, to show the space occupied by the new-formed ligamentous substance.

EXPLANATION OF PLATE II.

No. 1. and 2. Are specimens from the collection of the late Dr. Hunter.

No. 1. Was entirely concreted on the internal surface from a. to b.: that part circumscribed by the letters b. k. l. was filled up with strong ligamentous fibres. Besides the transverse fracture a. k. there seems to have been a small fragment at c. d. e. as is evident in the side view of the same *Patella*.

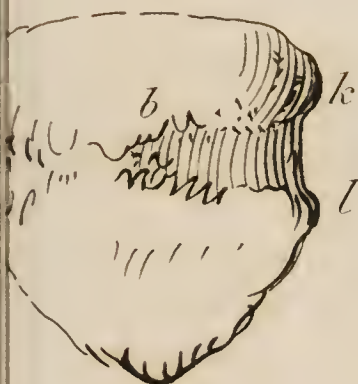
No. 2. Is a transverse fracture concreted on its external surface f. g. h. i.—the whole internal surface had a scabrous appearance. These, and a third which was not united, are described in a Dissertation on the Fracture of the *Patella*, published by Professor Camper in the year 1754.

No. 3. Is a *Patella* of the right knee; it was fractured transversely, and completely united on the whole divided surfaces, not above a line intervening; a fragment is also added here at a. m. o. as in No. 1.

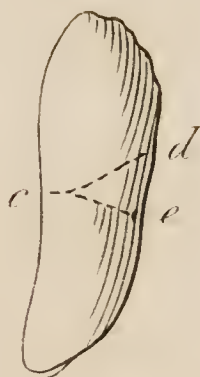
No. 4. Is a transverse fracture of a *Patella* not united; the upper portion was enlarged laterally from an irregular *Callus* at p. q. r. These two last figures are drawn from memory, as the gentleman in whose possession they were, would not permit drawings to be made from them.—From all these figures it is evident that a fractured *Patella* may be united, although, from the present practice, it rarely happens: among the many specimens which Professor Camper had seen, he had never observed but two completely united *.

* Very few Surgeons have seen so many; and where osseous union does occur, the Editor thinks it should be considered more as a deviation from a general rule, than as a circumstance to be looked for. See remarks on this subject in a work, entitled, *Some Practical Observations in Surgery*, by A. Copland Hutchison. Published in 1816.

N^o 1.



N^o 2.



N^o 3.



N^o 4.



